A national accounts satellite for human capital and education

Frits Bos

2011

EAGLE ECONOMICS & STATISTICS
Lindenlaan 24, 2651 TK Berkel en Rodenrijs
Netherlands
eagle_econstat@kpnmail.nl

A national accounts satellite for human capital and education

Frits Bos

Eagle Economic & Statistics Working Paper 2011-01

(An earlier draft was presented at the IARIW-conference in Lillehammer 1996; following various requests, this fifteen year old paper has been updated and extended)

Abstract

The official national accounts statistics do not show the role of human capital in the national economy. A set of satellite tables supplementing the standard national accounts statistics could serve this data need. In this satellite account, expenditure on education and training are recorded as human capital formation. This includes not only the expenditure on primary, secondary and tertiary education, but also expenditure on training and courses by employers and the earnings foregone by students. Consumption of human capital is allocated to various persons and industries as a charge on their income; it is not part of final consumption expenditure. The satellite shows more comprehensively than OECD Education at a Glance who pays for human capital formation. It also shows how education and training are employed in the national economy. In line with calculations of private and social rates of return, taxes and subsides on labour income and the relative prices of various types of labour (high-skilled, medium-skilled, low-skilled) are also shown. Links could be made with labour accounts broken-down by level of education, productivity and growth accounts and tables on expenditure by function of government, households and corporations. A simple decomposition analysis can show the role of demography and participation rates in the development of public expenditure on education. The satellite could be regarded as a macro-economic framework supplementing the OECD-statistic Education at a Glance.

Key words: Human capital, education, economic growth, public expenditure on education, national accounts satellite, statistics on education

JEL code: B16, B22, B23, C82, D70, E01, E60, O10, O20, O47, O57, Q56

1. Introduction

For centuries, the importance of human capital has been stressed by economists like Cantillon, Smith, Say, Mill and Marshall. For example, in Marshall's Principles of Economics it is stated that:

"the wisdom of expending public and private funds on education is not to be measured by its direct fruits alone. It will be profitable as a mere investment, to give the masses of the people much greater opportunities than they can generally avail themselves of. For by this means many, who would have died unknown, are enables to get the start needed for bringing out their latent abilities. And the economic value of one great industrial genius is sufficient to cover the expenses of the education of a whole town; for one new idea, such as Bessemer's chief invention (F.B.: for making wrought iron and steel), adds as much to England's productive power as the labour of a hundred thousand men. Less direct, but not less in importance, is the aid given to production by medical discoveries such as those of Jenner or Pasteur, which increase our health and working power; and again by scientific work such as that of mathematics or biology, even though many generations may pass away before it bears visible fruit in greater material wellbeing. All that is spent during many years in opening the means of higher education to the masses would be well paid for if it called out one more Newton or Darwin, Shakespeare or Beethoven. There are few practical problems in which the economist has a more direct interest than those relating to the principles on which the expense of the education of children should be divided between the State and the parents" (pp. 179,180).

An estimate of the value of human capital stock was already made in 1691 by Petty, the founding father of national accounting (see Kiker, 1966)[1].

In the first part of the twentieth century, the subject was mostly neglected. This situation drastically changed with the work of Theodore Schultz and Gary Becker in the sixties. At approximately the same time, Denison started his pioneering work on growth accounting and also stressed the importance of human capital for economic growth (Denison, 1962; on growth accounting in general see Maddison, 1987 and Abramovitz, 1989). Recently, 'new'

[1] On the history national accounting, see Bos (2008) and Bos (2009), chapters 2, 3 and 4.

growth theory has become very popular. New growth theory suggests increasing returns (spill-over effects) for specific inputs, like expenditure on Research and Development, innovation and human capital (see e.g. Romer, 1986 and Grossman and Helpman, 1991). In development economics, it is even the general opinion "that the formation of human capital is important, perhaps even central, to the development effort in poor countries. When increased productivity results from formal education, health and nutrition, effective job search, migration or on-the job training, we see the results of past investments in human capital. Abstention from consumption (saving) and expenditure to increase investment together yield returns in future periods, just as investments in physical capital would yield returns" (Herrick and Kindleberger, 1984, p. 193). Large changes in the age structure of a country can even necessitate a large increase in government expenditure on formal education.

As a consequence of all these developments, the concept of human capital plays a prominent role in current economic theory and, partly independently of the opinions of economic theorists, in current economic policy.

The concepts in the international guidelines on national accounting, the SNA and the ESA, are the worldwide standards for measuring, monitoring and analysing economic growth. However, these international standards are not well suited to analyze the relationship between human capital and economic growth. The most fundamental reason is that the concept of human capital is absent in the standard national accounts. This applies not only to the most recent generation of international guidelines on national accounting, the SNA 1998 and the ESA 2010, but also to all the earlier generations of guidelines that have been issued since 1947[2].

The OECD statistic Education at a Glance is the international reference statistic on education. It could be regarded as a statistic about the production, financing and use of human capital. OECD Education at a Glance presents various indicators of financial resources invested in education: educational expenditure per student, expenditure on educational institutions, public expenditure on education and support for students and households through public subsidies. However, in view of human capital theory a comprehensive concept of expenditure on education is missing.

[2] On these guidelines, see Bos (1993), Bos (1994) and Bos (2009, chapters 3, 4 and 6).

Such a concept should not only include expenditure on educational institutions, but also scholarships and earnings forgone by students. By not including estimates of the earnings foregone by students, the economic importance of such private investments in human capital is underestimated.

The comprehensive concept of expenditure on education should also include various forms of adult-learning, e.g. expenditure on training and courses by employers and employees. These expenditure are important for maintaining and improving human capital. By ignoring these expenditure, educational policy may get a too narrow focus.

In the 2004 edition of Education at a Glance, for the first time estimates of the labour market returns of education have been included. These private and social rates of return are the net result of the investments in human capital and the earnings differentials as a result of these investments. The social rate of return is determined as the net result of total investment in human capital (including earnings foregone by students!) and the gross earnings differential. The private rate of return is calculated on the basis of the private investments in human capital and the after tax earnings differential.

These estimates of labour market returns on education are fully in line with human capital theory. However, the OECD concepts of expenditure on education have no clear link with human capital theory. They do not correspond to the public or private investments used in calculating private and social rates of return.

In this paper, a satellite for human capital and education supplementing the standard national accounts is presented[3]. In section 2, the satellite and its major tables is presented[4]. For a proper interpretation of such data and use of government policy, further analysis is often

[3] A general introduction to satellites is provided by chapter 22 Satellite accounts in ESA 2010 (Eurostat, 2011). It describes and discusses how the central framework of the national accounts can be used as a building-block-system to serve specific data needs. It provides brief descriptions of nine different satellite accounts and discusses the major characteristics that can apply: a) Links to functions, as in functional satellite accounts, b) Links to industries or products, c) Links to institutional sectors, d) Extension with physical or non-monetary data, e) Extra detail, f) Use of supplementary concepts, g) Modification of some basic concepts, h) Use of modeling or inclusion of experimental results. On satellite accounts, see also Bos (2009), section 6.9, pp. 233-259.

[4] This section corresponds to section 6.9.3 in Bos (2009) and is an update of the paper presented at the IARIW Conference in Lillehammer 1966 (Bos, 1996).

required. Section 3 presents a simple but very insightful method of analysis requiring only a very limited amount of data. The development of Dutch public expenditure on education since 1950 is analysed by a simple decomposition quantifying the impact of demography, participation in education and labour and wages rates of teachers deviating from the general labour productivity increase[5]. Conclusions are drawn in section 4.

[5] This section is based on the analysis of Dutch public expenditure in Bos (2006), in particular section 4.3 on education.

2. The satellite on human capital and education

Theodore Schultz, the path breaker in the economics of education, distinguishes three components of education (Schultz, 1961, p. 1037):

"(1) education for current consumption (which ... is of minor importance);

(2) education for long-period future consumption, making it an investment in an enduring consumer component, which is undoubtedly of considerable importance;

and (3) education for skills and knowledge useful in economic endeavour and, thus, an investment in future earnings".

The conventions in the international guidelines on national accounting treat all expenditure on education as belonging to 'current consumption':

- expenditure on education by households or government are recorded as final consumption;
- expenditure by enterprises on education are regarded as intermediate consumption or, when the expenditure mainly provide a net benefit to the employee, as part of compensation of employees and final consumption.

Schultz's second component of education, i.e. education for long-period future consumption, can be described as education which helps to enjoy reading newspapers or books, visiting museums or listening to music. This concept is absent in the standard national accounts. Similarly, Schultz's third component of education, i.e. education as an investment in future earnings, is also absent in the standard national accounts.

In the satellite, attention is focused on introducing human capital formation for 'production purposes' (i.e. Schultz's third component). The satellite's concept of human capital formation includes therefore only expenditure on education and training of people who are part of the potential labour force. The potential labour force includes those that are expected to join the labour force (e.g. children), those who are already part of the labour force (the employed and unemployed) and those that could join the labour force but are presently engaged in other activities (e.g. unpaid household services). Extending the production and asset boundary as suggested by Schultz's second component (education for long-period future consumption) is not taken up in the concepts of the satellite.

The national accounts distinction between work-in-progress (changes in inventories) and fixed capital formation is also applied to our concept of human capital formation. Expenditure on education is registered as work-in-progress when it pertains to people (e.g. children) that will enter the labour force in future. At the time they enter the labour force, their accumulated human capital should be recorded as a negative change in stocks and as fixed capital formation by the same amount. Expenditure on education and training pertaining to people in the labour force is directly recorded as fixed capital formation. Expenditure on education pertaining to people outside the potential labour force (i.e. on elderly people), should not be recorded as capital formation at all. The reason is that they are not part of the (productive) human capital stock.

Diplomas are often granted when education or training programmes are completed successfully. The concept of fixed human capital formation could be linked to attaining diplomas: expenditure which do not result in diplomas should not be recorded as fixed capital formation.

In the satellite, for simplicity's sake, no expenditure on education and training are recorded as expenditure on the maintenance of human capital. This applies also to, e.g., refresher courses for teachers.

In the satellite, the concept of human capital is limited to the actual costs of formal education and training. Costs of rearing like those for food and shelter and costs of health care are excluded from the satellite's concept of human capital formation. Such costs are included in the concept of human capital in the Total Accounts compiled by Kendrick (1976). In the satellite, costs of rearing and health care are recorded as final consumption expenditure, like in the standard national accounts.

We will shortly motivate why costs of rearing and healthcare are not part of the concept of human capital employed in the satellite. In principle, only that part of the expenditure which is intended to contribute to future production should be recorded as formation of (productive) human capital. In developed countries a major part of expenditure on food and drinks is not primarily aimed at nutrition, i.e. primarily aimed at constructing and maintaining the human body as a productive asset. This applies for example to expenditure on snacks, caviar, cola, wine, beer, etc.: they can best be regarded as luxury expenditure, i.e. expenditure for fun and

entertainment. Similarly, a major part of the expenditure on health care is for consumption purposes, e.g., on elderly people outside the potential labour force. Expenditure on rearing and healthcare are therefore best regarded as final consumption or as human capital formation for final consumption purposes. In the satellite, these expenditure are thus not incorporated in the concept of (productive) human capital.

In the satellite, human capital formation is limited to actual expenditure on formal education and training. As a consequence, no attention is paid to the role of learning-by-doing or to informal education by parents, newspapers, educational tv programmes, etc.

Human capital formation is valued as the sum of the expenditure on education plus earnings foregone by students. The idea to regard earnings foregone by students as part of the costs of human capital formation was a major contribution of Schultz (1960). Since then, it has been widely used for estimating the value of human capital formation, e.g. in the Total Accounts of Kendrick (1976).

In the satellite, human capital formation is valued as the sum of expenditure on education and training. This principle of valuation is in line with the valuation of the other assets in the standard national accounts: they are all to be valued at the current exchange value and not at net present values (see Bos, 1995, section 5 and Bos, 1997).

The net present value approach to human capital dates back to the estimates by Petty in 1691 (see Kiker, 1966). A recent example of estimates on the basis of the net present value approach is Jorgenson and Fraumeni (1989). They record human capital at net present value, while all the other non-financial assets are recorded at current exchange values as they are derived from the standard national accounts. This amounts to mixing up forward looking concepts of valuation (net present values) with current exchange values, i.e. two fundamentally different principles of valuation.

The net present values could be regarded as approximations of the current exchange values. However, this is only valid under a lot of assumptions, e.g. about the existence of a strong market mechanism for human capital, perfect information on future earnings, absence of risk and uncertainty, low transaction costs, existence of a full range of future markets, etc. Furthermore, the discount rate and earnings patterns actually chosen in calculating the net

present value should be reasonable reflections of the expectations and preferences. Slight changes in the discount rate and earning patterns assumed may lead to drastic changes in the net present value. Net present value estimates are thus not a very robust and reliable way of approximating current exchange values.

The satellite focuses on the supply and use tables[6]. In three steps the standard supply and use tables can be transformed into tables targeted at describing and analysing the role of education, training and courses as human capital in the national economy. For illustrative purposes, the tables contain fake figures about "Polderland", i.e. an economy roughly about twice the size of the Dutch economy.

Focus on education, training & courses

The first step (see tables 2.1 and 2.2) is to highlight all information relevant and to suppress all irrelevant information. This implies that education and training & courses are explicitly shown as products, while all other products are not shown anymore. Furthermore, compensation of employees is broken down by level of education of the employees involved. The same applies to the volume of labour shown as supplementary information. The first step achieves that the expenditure by households and the government on education and the expenditure by the various industries on training are explicitly shown. It also reveals the extent to which the various industries depend on high-educated personnel.

Compensation of employees is a payment for a factor service

The second step (see tables 2.3 en 2.4) is to treat compensation of employees as a payment for a product instead of as payment for a factor service and category of value added. This implies that:

- the supply and use of products is increased with labour supply services;
- cross-border workers are providing imports and exports of labour supply services;
- taxes and subsidies on compensation of employees (wage taxes and wage subsidies) become taxes and subsidies on products; these are explicitly shown in the supply table;

[6] An introduction to supply and use tables is provided by chapter 9 Supply and use tables and the input-output framework of ESA 2010 (Eurostat, 2011).

- the price- and volume changes of the various types of labour supply services are incorporated in the supply and use tables.

Furthermore, net value added at basic prices is mainly reduced to operating surplus and mixed income. This reflects the changing role of employees in modern services-oriented economies: employees should be regarded as entrepreneurs selling a wide range of different labour supply services. For this specific type of entrepreneurs a new industry is introduced: employees. Their operating surplus is equal to compensation of employees minus taxes on wages paid by employees and minus consumption of human capital.

Human capital formation and human capital stock

Employees as entrepreneurs can also invest in human capital to improve or adjust their labour supply services. The third step (see table 2.5 en 2.6) is therefore to introduce human capital. In the use table, this implies that expenditure on education and training are recorded as capital formation instead of as intermediate consumption or final consumption. Human capital formation should include also some opportunity costs. For employers, the wage costs of the personnel while following the training and courses are a substantial part and often even biggest costs of training and courses. Official statistics on business expenditure on training and courses therefore include these opportunity costs. Furthermore, for students the costs of education do not only consist of school fees. The earnings foregone by studying instead of working are generally a much more important cost item. The implication of including the earnings foregone of students as human capital formation is that they should also be recorded as output, value added and operating surplus. To this end, a new type of industry is added: students producing human capital by amount of their earnings foregone.

In general, those who pay for capital formation are also the owner of the new asset. However, in case of investment grants this does not apply: the government partly finances the capital formation but will not be the owner of the new asset. The government plays also an

important role in financing human capital formation, e.g. by providing education as other non-market output or by scholarships. The latter should be regarded as investment grants for human capital formation. The individual persons receiving these investments grants are the owners of the corresponding human capital. Training and courses organised and financed by employers could be regarded as income in kind or investment grants to employees. However, we prefer to record this expenditure as capital formation by the employer.

The accumulation of human capital induces consumption of fixed capital. Following the basic national accounting principles, this should be calculated by the Perpetual Inventory Method. Expected economic life times for investments in education by individuals could be assumed to be 40 years on average; this corresponds to being productive during 40 years, e.g. from 25 to 65 years. In fact, different economic life times should be assumed for different types of human capital formation, for persons differing in age and sex and for different circumstances of work (e.g. diseases linked to certain professions).

The major part of the consumption of human capital pertains to employees. The net operating surplus of these employees is equal to their compensation of employees minus taxes on wages paid by employees and minus consumption fixed capital. Consumption of human capital can also pertain to those not employed, e.g. those receiving unemployment benefits, disablement benefits or those who choose not to have paid employment (e.g. housewives and –men). They do not have benefits related to their human capital. As a consequence, their net operating surplus is negative by amount of their consumption of fixed capital. This is shown in a new industry for the not employed.

For the training and courses by employers, a much shorter life time is realistic, because employers bear the risk that an employee takes a job elsewhere. An expected economic life time of about 5 years could then be a reasonable assumption.

Supplementary information

The supply and use table do not show the financing of human capital formation, e.g. the role of investments grants by the government. This aspect can be revealed by a simple supplementary table (see table 2.7). The table shows that the total investment in human capital was 109 bln euro in 2008. Major components of this investment are the expenditure by employers and the earnings foregone by students.

The satellite can also be extended with a table showing the population by age, sex and level of education and a table linking the population and the employed labour force, e.g. the number of first and second jobs and the number of hours worked. Ideally, such statistics on the population and employment are part of a system of Labour accounts/Social-Accounting Matrix with breakdowns by level of education[7].

Also links could be made with expenditure on Research and Development (see e.g. Bos, et al, 1994 and ESA 2010, paras 22.108-22.109) and productivity and growth accounts (see ESA 2010, paras 22.99-22.107).

[7] On Labour Accounts and Social Accounting Matrixes, see ESA 2010, paras 22.96-22.98.

Table 2.1 First step: A supply table focusing on education in bln euros Polderland 2008

	Output at basic prices by (domestic) industries					*Imports*	*Total Supply at basic prices*	*Trade & Transp. Margins*	*Taxes on products*	*minus Subsidies on products*	*Total Supply at pur-chasers' prices*
	Goods producers	Trade & transport producers	Financial & business services producers	Social & personal services producers	Total output by product						
Products											
Education	0	0	0	35	35	0	35	0	0	0	35
primary	0	0	0	12	12	0	12	0	0	0	12
secondary	0	0	0	14	14	0	14	0	0	0	14
tertiairy	0	0	0	9	9	0	9	0	0	0	9
Training & courses	0	0	4	0	4	0	4	0	0	0	4
Other products	621	281	283	206	1391	430	1821	0	90	-8	1903
Total output	621	281	287	241	1430	430	1860	0	90	-8	1942
Suppl. information											
Sectors											
Non-financ. corp.	551	211	154	88	1004						
Financial corp.	0	0	70	0	70						
General government	7	0	7	133	147						
Households	63	70	56	20	209						
Total output at basic prices	621	281	287	241	1430						

Table 2.2 First step: A use table focusing on education in bln euros, Polderland 2008

	Input by industry (Interm. cons., Gross Value Added)					*Final consumption*				*Gross*	*Exports*	*Total*
	Goods producers	Trade & transport producers	Financial & business services producers	Social & personal services producers	Total input	House-holds	Government other non-market output	social benefits via m.p.	Total	*Capital Forma-tion*		*Use at pur-chasers' prices*
Products	*(Intermediate consumption)*					*(Final uses)*						
Education	0	0	0	0	0	2	33	0	35	0	0	35
primary	0	0	0	0	0	0	12	0	12	0	0	12
secondary	0	0	0	0	0	1	13	0	14	0	0	14
tertiairy	0	0	0	0	0	1	8	0	9	0	0	9
Training & courses	1	1	1	1	4	0	0	0	0	0	0	4
Other products	407	123	100	81	733	382	90	56	528	169	473	1903
Use of products	408	124	101	82	737	384	123	56	563	169	473	1942
Cons. of fixed capital	31	23	35	25	114							
Compens. employees	107	89	82	115	393							
low skilled	23	11	1	5	40							
medium skilled	61	65	30	14	170							
high skilled	23	13	50	96	183							
Other taxes on production	3	1	3	1	8							
minus Other subs.	-4	-1	-1	-1	-7							
Operating surplus/Mixed income	76	45	67	19	207	Taxes on products	Subs.on products	NDP market pr.				
FISIM-correction at the national level					-22							
Net Value Added at basic pr.	182	134	151	134	579	90	-8	661				
Output at basic prices	621	281	287	241	1430							
Supplementary information												
Capital formation	46	34	52	37	169							
Capital stock at the end	1156	857	1305	932	4250							
Volume of labour	3,3	2,8	2,6	3,6	12,3							
low skilled	1,0	0,5	0,1	0,2	1,2							
medium skilled	1,9	2,1	1,5	1,4	7,2							
high skilled	0,5	0,3	1,1	2,0	3,8							

Table 2.3 Second step: A supply table with labour as a product in bln euros Polderland 2008

	Output at basic prices by (domestic) industries						*Imports*	*Total Supply at basic prices*	*Trade & Transp. Margins*	*Taxes on products*	*minus Subsidies on products*	*Total Supply at pur-chasers' prices*
	Goods producers	Trade & transport producers	Financial & business services producers	Social & personal services producers	Employees	Total output by product						
Products												
Labour supply services	0	0	0	0	348	348	2	350	0	44	-4	390
low skilled	0	0	0	0	37	37	1	38	0	2	-4	36
medium skilled	0	0	0	0	152	152	0	152	0	18	0	170
high skilled	0	0	0	0	159	159	1	160	0	24	0	184
Education	0	0	0	35	0	35	0	35	0	0	0	35
primary	0	0	0	15	0	15	0	15	0	0	0	15
secondary	0	0	0	15	0	15	0	15	0	0	0	15
tertiairy	0	0	0	5	0	5	0	5	0	0	0	5
Training & courses	0	0	4	0	0	4	0	4	0	0	0	4
Other products	621	281	283	206	0	1391	430	1821	0	90	-8	1903
Total output	621	281	287	241	348	1778	432	2210	0	134	-12	2332
Suppl. information												
Sectors												
Non-financ. corp.	551	211	154	88	0	1004						
Financial corp.	0	0	70	0	0	70						
General government	7	0	7	133	0	147						
Households	63	70	56	20	348	557						
Total output at basic prices	621	281	287	241	348	1778						

Table 2.4 Second step: A use table with labour as a product in bln euros, Polderland 2008

	Input by industry (Interm. cons., Gross Value Added)						*Final consumption*				*Gross*	*Exports*	*Total*
	Goods producers	Trade & transport producers	Financial & business services producers	Social & personal services producers	Employees	Total input	House-holds	Government other non-market output	social benefits via m.p.	Total	*Capital Forma-tion*		*Use at pur-chasers' prices*
Products	*(Intermediate consumption)*						*(Final uses)*						
Labour supply services	104	88	82	115	0	389	0	0	0	0	0	1	390
low skilled	20	10	1	5	0	36	0	0	0	0	0	0	36
medium skilled	61	65	30	14	0	170	0	0	0	0	0	0	170
high skilled	23	13	50	96	0	183	0	0	0	0	0	1	184
Education	0	0	0	0	0	0	2	33	0	35	0	0	35
primary	0	0	0	0	0	0	0	15	0	15	0	0	15
secondary	0	0	0	0	0	0	1	14	0	15	0	0	15
tertiairy	0	0	0	0	0	0	1	4	0	5	0	0	5
Training & courses	1	1	1	1	0	4	0	0	0	0	0	0	4
Other products	407	123	100	81	0	733	382	90	56	528	169	473	1903
Use of products	512	212	183	197	0	1126	384	123	56	563	169	474	2332
Cons. of fixed capital	31	23	35	25	0	114							
Other taxes on production	3	1	3	1	0	8							
minus Other subs.	-1	-1	-1	0	0	-3							
Operating surplus/Mixed incom	76	46	67	18	348	555	Taxes on products	Subs.on products	NDP market pr.				
FISIM-correction at the national level						-22							
Net Value Added at basic pr.	78	46	69	19	348	538	134	-12	660				
Output at basic prices	621	281	287	241	348	1778							
Supplementary information													
Capital formation	46	34	52	37	0	169							
Capital stock at the end	1156	857	1305	932	0	4250							
Volume of labour	3,3	2,8	2,6	3,6	0,0	12,3							
low skilled	1,0	0,5	0,1	0,2	0,0	1,2							
medium skilled	1,9	2,1	1,5	1,4	0,0	7,2							
high skilled	0,5	0,3	1,1	2,0	0,0	3,8							

Table 2.5 Third step: A supply table with human capital in billion euros Polderland 2008

	Output at basic prices by (domestic) industries								*Imports*	*Total Supply at basic prices*	*Trade & Transp. Margins*	*Taxes on product.*	*minus Subsidies on products*	*Total Supply at pur-chasers' prices*
	Goods producers	Trade & transport producers	Financial & business services producers	Social & personal services producers	Employees	Students as students	Not employed	Total output by product						
Products														
Labour supply services	0	0	0	0	348	0	0	348	2	350	0	44	-4	390
low skilled	0	0	0	0	37	0	0	37	1	38	0	2	-4	36
medium skilled	0	0	0	0	152	0	0	152	0	152	0	18	0	170
high skilled	0	0	0	0	159	0	0	159	1	160	0	24	0	184
Education	0	0	0	35	0	45	0	80	0	80	0	0	0	80
primary	0	0	0	15	0	0	0	15	0	15	0	0	0	15
secondary	0	0	0	15	0	30	0	45	0	45	0	0	0	45
tertiairy	0	0	0	5	0	15	0	20	0	20	0	0	0	20
Training & courses	5	4	9	5	0	0	0	23	0	23	0	0	0	23
internal	2	1	2	2	0	0	0	7	0	7	0	0	0	7
external	3	3	7	3	0	0	0	16	0	16	0	0	0	16
Other products	621	281	283	206	0	0	0	1821	430	1757	0	90	-8	1839
Total output	626	285	292	246	348	45	0	1826	432	2210	0	134	-12	2332
Suppl. information														
Sectors														
Non-financ. corp.	556	215	157	89	0	0	0	1017						
Financial corp.	0	0	72	0	0	0	0	72						
General government	7	0	7	137	0	0	0	151						
Households	63	70	56	20	348	45	0	602						
Total output at basic pric	626	285	292	246	348	45	0	1842						

Table 2.6. Third step: A use table with human capital in billion euros, Polderland 2008

	Input by industry (Interm. cons., Gross Value Added)								*Final consumption*				*Gross*	*Exports*	*Total*
	Goods producers	Trade & transport producers	Financial & business services producers	Social & personal services producers	Employees	Students as students	Not employed	Total input	House-holds	Government other non-market output	social benefits via m.p.	Total	*Capital Forma-tion*		*Use at pur-chasers' prices*
Products	*(Intermediate consumption)*								*(Final uses)*						
Labour supply services	107	89	82	115	0	0	0	393	0	0	0	0	0	0	390
low skilled	23	11	1	5	0	0	0	40	0	0	0	0	0	0	36
medium skilled	61	65	30	14	0	0	0	170	0	0	0	0	0	0	170
high skilled	23	13	50	96	0	0	0	183	0	0	0	0	0	0	184
Education	0	0	0	0	0	0	0	0	0	0	0	0	80	0	80
primary	0	0	0	0	0	0	0	0	0	0	0	0	15	0	15
secondary	0	0	0	0	0	0	0	0	0	0	0	0	45	0	45
tertiairy	0	0	0	0	0	0	0	0	0	0	0	0	20	0	20
Training & courses	0	0	0	0	0	0	0	0	0	0	0	0	23	0	23
internal	0	0	0	0	0	0	0	0	0	0	0	0	7	0	7
external	0	0	0	0	0	0	0	0	0	0	0	0	16	0	16
Other products	408	124	101	82	0	0	0	737	384	123	56	563	66	473	1839
Use of products	515	213	183	197	0	0	0	1130	384	123	56	563	169	473	2332
Cons. of fixed capital	37	28	45	31	45	0	15	201							
Other taxes on productio	3	1	3	1	0	0	0	8							
minus Other subs.	-1	-1	-1	0	0	0	0	-3							
Operating surplus/Mixed	101	44	62	17	303	45	-15	512	Taxes o produc	Subs.on products	NDP market pr.				
FISIM-correction at the national level								-22							
Net Value Added at basi	103	44	64	18	303	45	-15	495	134	-12	617				
Output at basic prices	655	285	292	246	348	45	0	1826							
Supplementary information															
Capital formation	52	39	62	43	70	0	10	276							
human capital	6	5	10	6	70	0	10	107							
other	46	34	52	37	0	0	0	169							
Capital stock at the end	1171	870	1330	947	1050	0	300	5668							
human capital	15	13	25	15	1050	0	300	1418							
other	1156	857	1305	932	0	0	0	4250							
Volume of labour	3,3	2,8	2,6	3,6	0,0	0,0	0,0	12,3							
low skilled	1,0	0,5	0,1	0,2	0,0	0,0	0,0	1,7							
medium skilled	1,9	2,1	1,5	1,4	0,0	0,0	0,0	6,8							
high skilled	0,5	0,3	1,1	2,0	0,0	0,0	0,0	3,8							

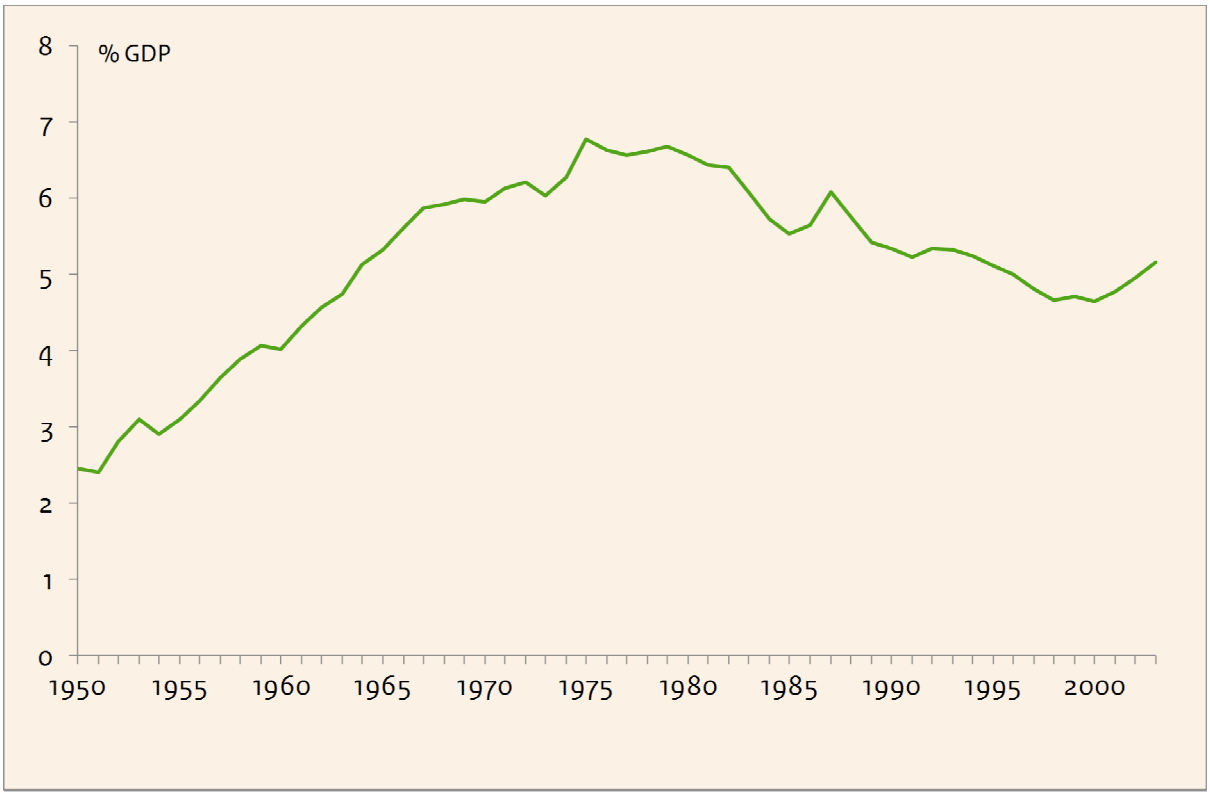
Table 2.7 Composition, size and development of expenditure on human capital in Polderland

	2008	% of total	volume change	price change
Expenditure by the government				
Individual other non-market output	33	30%	5%	4%
primary education	15	14%	5%	4%
secondary education	14	13%	5%	4%
tertiary education	4	4%	2%	4%
Social benefits in kind via market producers	2	2%	2%	3%
Social benefits in cash (scholarships)	2	2%	2%	1%
Total expenditure by the government	37	34%	4%	4%
Expenditure by employers				
Training & courses	23	21%	4%	4%
internal	7	6%	2%	3%
external	16	15%	5%	5%
Total expenditure by employers	23	21%	4%	4%
Expenditure by households				
Expenditure on books, paper and travel costs	2	2%	2%	3%
School fees	2	2%	3%	3%
Earnings foregone	45	41%	2%	4%
Total expenditure by households	49	45%	2%	4%
Total expenditure on human capital	109	100%	3%	4%

3. Analysing the development of Dutch public expenditure on education

Dutch public expenditure on education[8] increased from 2% GDP in 1950 to nearly 7% GDP in 1975 (see figure 3.1). It decreased then to 6% GDP in 1983 and 5% GDP in 2003. This implies that before 1975 the real growth rate of public expenditure on education[9] was much larger than GDP volume growth. Since then the real growth rate of these expenditure was smaller than GDP volume growth. What were the major causes of this?

Figure 3.1 Dutch public expenditure on education as % GDP, 1950-2003



The decomposition method for analysing the change in public expenditure as % GDP

The change in public expenditure like those on education as a percentage of GDP can be analysed by decomposition analysis. The first step is to decompose into the growth rate of

[8] Public expenditure on education is defined here in terms of national accounts statistics, i.e. the aggregate of compensation of employees, intermediate consumption and capital formation by the industry (subsidised) education plus scholarships and free rail transport for students. This is broadly similar to total public expenditure on education in OECD Education at a glance; minor differences are that OECD deducts schoolfees, while adding interest charges of schools.

[9] The real growth rate is the nominal growth rate deflated by the price change in GDP.

real public expenditure per capita and the volume growth of GDP per capita (see table 3.1)[10]. This decomposition indicates that the change in public expenditure as a percentage of GDP rises (/falls) when real public expenditure per capita grows faster (/less) than volume growth of GDP per capita.

Table 3.1 Growth rate of real public expenditure per capita in the Netherlands during 1951-2003

	1951-1983	1984-2003	1951-2003
	average annual growth rate (%)		
Distributive policy	6.4	0.6	4.2
Social security	7.3	– 0.4	4.3
Publicly financed health care	8.4	4.3	6.8
Education	5.7	1.2	3.9
Transfers to corporations	4.3	– 2.4	1.7
Other policy	3.6	1.9	3.0
Public administration and safety	4.5	2.4	3.7
Defence	2.2	– 2.3	0.4
Infrastructure	1.8	3.3	2.3
International cooperation	3.5	2.1	3.0
Interest	5.0	– 1.3	2.5
Gross public expenditure	5.1	0.9	3.5
GDP (volume per capita)	2.8	2.0	2.5
Productivity	3.3	1.2	2.5
Employment per capita	– 0.5	0.8	0.0
Demography	0.2	0.3	0.2
Labour market participation	– 0.7	0.6	– 0.2
Population growth	1.1	0.6	0.9

The volume growth of GDP per capita can be split into:

- Productivity growth;
- Change in employment per capita.

The latter can be subsequently split into:

- Demographic change due to changes in the relative size of the potential labour force (20-64) compared to the total population;

[10] This is based on the equation: the growth rate of the change in public expenditure as a percentage of GDP is equal to the growth rate of public expenditure per capita deflated by the price of GDP ('the real growth rate') per capita minus the growth rate of the volume of GDP per capita. If the real growth rate (per capita) of public expenditure is equal to the growth rate of the volume of GDP (per capita), its size as a percentage of GDP remains by definition constant.

- Change in employment compared to the size of the potential labour force ('labour market participation'). In this case, employment is expressed in full-time equivalents and not in number of employed.

Changes in the relative size of the potential labour force and the labour market participation lead therefore –mutatis mutandis– to change in public expenditure as a percentage of GDP.

A further analysis by function should take account of the specific features of the various expenditure functions. This does not only apply for determinants like the interest rate and the wage rate but also for changes in demography. The only exception is the change in labour market participation. This causes an effect via the denominator of total public expenditure and is thus relevant for all expenditure functions.

Productivity growth also affects GDP but leads to a much lesser extent to denominator effects on public expenditure as a percentage of GDP. The reason is that most public expenditure are closely linked to productivity growth. For example, real wages and social benefits have a rather close relationship with productivity growth[11].

The decomposition analysis is a simple method to quantify the various determinants on Dutch public expenditure as a percentage of GDP are quantified. These effects are partial effects calculated on the basis of the size and composition of Dutch public expenditure in 1983 and 2000. These partial effects address questions like:

- What would have been the size of the old age benefit by the state (AOW), public expenditure on education or total public expenditure as a percentage of GDP in 2003 when no change in demographic composition had occurred?
- What would have been the size of the old age benefit by the state (AOW) as a percentage of GDP in 2003 when the benefit had followed the general increase in productivity?
- What would have been the size of public expenditure on education as a percentage of GDP in 2003 when the wages in education had developed in line with the general increase in productivity?

The aggregate of these partial effects does not add up to the total effect on public expenditure as a percentage of GDP, because the total effect includes also all kinds of interactions

[11] When growth of real wages and social benefits is structurally lower than productivity growth, public wages or social benefits as a percentage of GDP will -mutatis mutandis- fall over time.

between these partial effects. The net effect of these interactions is reflected by a residual item.

A decomposition for Dutch public expenditure on education

In table 3.2, Dutch public expenditure on education is split into two parts:

- scholarships and free rail-transport for students
- production costs for providing education services.

Table 3.2 Dutch public expenditure on education since 1950

	1950	1983	2003	1951-1983	1984-2003
	level % GDP			change % GDP	
Total education	2.4	6.1	5.2	3.6	– 0.9
Scholarships and free rail-transport	0.0	0.3	0.4	0.3	0.0
Production costs education	2.4	5.7	4.8	3.3	– 1.0

The expenditure on scholarships and free rail-transport was very small during the 1950s, 1960s and start of the 1970s (0.1% GDP or less). This increased then rapidly to 0.8% GDP at the end of the 1980s. Due to the combined effect of demography and a drastic reduction in the level and scope of individual scholarships by the government, this decreased to 0.4% GDP.

Table 3.3 Decomposition of the change in Dutch public expenditure as % GDP

	1951-1983	1984-2003
		change % GDP
Totaal	3.6	– 0.9
Scholarships and free rail-transport	0.3	0.0
Increase in number of pupils in excess of GDP volume growth	– 6.3	– 4.0
Demography	– 0.7	– 2.0
Participation in education	1.1	0.7
Other	– 6.7	– 2.7
Relative price per pupil/student	9.7	3.0
Lagging labour productivity	10.1	3.6
Volume input per pupil/student	6.1	2.5
General labour productivity increase (-)	– 4.0	– 1.1
Wage rate in excess of general labour productivity increase	– 0.3	– 0.2
Other	– 0.1	– 0.3

The production costs of education services can be analysed by comparing the growth rate of number of pupils/students with the growth rate of GDP and the relative price per pupil, i.e. the cost of education services per pupil in comparison to the price change in GDP (see table 3.3).

Demography influences public expenditure on education as a percentage of GDP via the nominator (the number of pupils/students) and via the denominator (GDP. Table 3.2 shows the most important demographic developments since 1950.

Table 3.4 Changes in Dutch demography during 1951-2003

	Total population	0-19 year	20-64 year	65+
			annual growth rate per year	
1951-1983	1.1	0.4	1.3	2.4
1983-2003	0.6	– 0.3	0.9	1.4
1951-2003	0.9	0.1	1.1	2.0

Education is mostly followed when young, i.e. 5 to 24 year. The demographic effect on public expenditure on ageing is therefore determined by comparing the development of the young part of the population (demography in the numerator of expenditure on education) with that of the potential labour force (20-64) (demography in the denominator GDP).

In the 1950s and 1960 the relative quick growth of the Dutch population between 5-24 in comparison to that of the potential labour force increased the number of pupils with 0.4% per year. Since the 1970 the demographic effect on education has become negative and on average about − 1% per year; in the period 1982-1995 it is even nearly − 2% per year. In the most recent years, the demographic effect on education is negligible. .

During the period 1951-1983 the population between 5-24-year decreased with 0.3% per year in comparison to the potential labour force. This can be translated in a budgetary saving of about 0.7% GDP in 1983: in 1983 expenditure on education services was 6% GDP and without such demographic effects it would have been about 10% smaller. Over the period 1984-2003 the average demographic effect for education was −1.6% per year. This corresponds to a budgetary saving in 2003 of 2.0% GDP.

The change in the number of pupils not due to demography is a participation effect: more children of the same age-cohort are participating in education. Since 1950 this effect is positive and more than 0.7% per year. Starting with the average costs per pupil this implies an extra budgetary cost of 1.1% GDP in the period 1951-1983 and 0.7% GDP in the period

1984-2003. The effect on public expenditure on education is probably much larger, because the increased participation is mainly located in the more expensive types of education, like higher education. The increased participation leads therefore also to an increase in the volume of expenditure per pupil. A more stratified calculation distinguishing the expenditure on the various types of education would have made this effect clearly visible.

The relative price per pupil can be broken down into three components:

- Lagging labour productivity growth;
- Changes in wage rates deviating from the general labour productivity increase;
- Other price differences.

In this decomposition, the lagging labour productivity growth is defined as the difference between the increasing volume of input per pupil (a gross productivity decline) and the general labour productivity increase.

In the 1950s and 1960s is the volume of the expenditure on education per pupil, i.e. the number of teachers and the quality of education facilities (e.g. housing, computers), increased with more than 3% per year. This reflects to a substantial extent a composition effect, i.e. the relatively fast growth of the more expensive types of education, like higher education. Since the 1970s this growth of expenditure per pupil was much smaller and became about 1% per year.

The increase in input per pupil could be interpreted as an increase in the average quality of education. However, there could also be changes in the productivity. According to Baumol's law (see Baumol, 1967 and Baumol, 1985), it is relatively difficult to increase productivity for such labour-intensive personal services, like education services. For the Netherlands, this is confirmed by estimates by SCP (Kuhry and van der Torre, 2002, p. 267). These estimates suggest that in the period 1990-1999 the productivity in primary education even dropped. As a consequence of this lagging productivity growth, the relative price of education services is likely to increase over time.

The increase in wage rates in the Dutch public sector was in both periods (1951-1983 and 1984 -2003)[12] on average somewhat smaller than the general labour productivity increase. This corresponds to a budgetary saving of about 0.3% GDP in both periods.

[12] For this analysis, using more specific wage rates, i.e. those in the education sector, is preferable.

4. Conclusions

In this paper, a set of satellite tables are presented on human capital and education. It serves to supplement the standard accounts statistics and the OECD-statistic Education at a Glance.

The major features of this satellite are:

- It provides a simple and systematic overview of the role of education and training in the national economy.
- The approach taken is a cost-accounting approach like in the standard national accounts and in the business accounts. However, expenditure on education and training and corresponding earnings foregone are regarded as human capital formation. Consumption of human capital is allocated to various industries and groups of persons as a charge on their income.
- The satellite shows who pays for human capital formation in a more comprehensive way than OECD-Education at a Glance.
- The satellite shows how education and training are employed in the national economy, e.g. which industry is most human capital-intensive.
- It also shows the role of taxes and subsidies on labour income and the changes in the relative prices of various types of labour. In this way, a link is established with the calculation of private and social rates of return on education.
- The satellite is derived from the standard national accounts. As a consequence, it has a straightforward link towards the major statistics on the national economy and government finance. The statistics from the satellite can therefore be analysed in the context of the national economy and government finance. Furthermore, national accounts statistics can serve as a data base for compiling the satellite. Finally, the definitions employed are readily available, being derived from the standard national accounts definitions.

Statistics like that of OECD at a Glance are often misinterpreted. For political discussions and international comparison, the focus is often on expenditure on education as a % GDP. However, this figure is a mixed bag of all kinds of effects like demography, participation, relative prices and productivity change. In section 3, it was shown for the Netherlands how a relatively simple decomposition analysis can quantify such effects.

References

Abramowitz, M., 1989, Thinking about growth. In: M. Abramowitz, Thinking about growth and other essays on economic growth and welfare (Cambridge University Press, Cambridge).

Bakker, G.P. den, 1992, Origin and development of the Dutch national accounts. National Accounts Occasional Paper nr. 56 (Netherlands CBS, Voorburg).

Becker, G.S., 1975 (second edition), Human capital; a theoretical and empirical analysis with special reference to education. (Columbia University Press, New York).

Baumol, W.J., 1967, Macroeconomics of unbalanced growth: the anatomy of urban crisis, *American Economic Review*, vol. 57, pp. 415-426.

Baumol, W.J., 1985, Productivity policy and the service sector, in R.P. Inman, red., *Managing the service economy: prospects and problems*, pag. 301-317, Cambridge University Press, Cambridge.

Bos, F., 1996, Human Capital and Economic Growth: A National Accounting Approach. Paper Presented at the 24th IARIW Conference, Lillehammer, Norway.

Bos, F., 2006, Dutch public expenditure in historical perspective (Nederlandse collectieve uitgaven in historisch perspectief), CPB Document 109.

Bos, F., 2008, Uses of national accounts: history, international standardization and applications in the Netherlands, MPRA paper 9837, University Library from Munich, Germany.

Bos, F., 2009, The National Accounts as a Tool for Analysis and Policy; in view of History, Economic Theory and Data Compilation Issues, VDM Publishers, Saarbrucken (updated and expanded version of PhD-thesis published by the author in 2003).

Bos, F., H. Hollanders and S.J. Keuning, 1994, A Research and Development Satellite Supplementing the National Accounts, Review of Income and Wealth, Series 40, nr. 3, September, pp. 273-286.

Bowman, M.J., 1966, The costing of human resource development. In: E.A.G. Robinson and

Vaizey, J.E., 1966, The Economics of education (MacMillan, London), pp. 421-450.

Coase, R., 1937, The nature of the firm. Economica 4, New Series 386.

Denison, E.F., 1962, The sources of economic growth in the United States and the alternatives before us, Committee for Economic Development, Supplementary Paper no. 13. (CED, New York), Ch. 7., pp. 68-80.

Eurostat, 2011, European System of National and Regional Accounts in the European Union (ESA 2010; downloadable via website of European Parliament, Legislative Observatory, reference COD/2010/0374).

Eisner, R., 1988, Extended accounts for national income and product, Journal of economic literature, Vol. XXVI, pp. 1611-1684.

Grossman, G.M. and E. Helpman, 1991, Innovation and growth in the global economy, MIT Press, Cambridge, Massachusetts.

Herrick, B. and C.P. Kindleberger, 1983, Economic development, McGraw Hill Book Co, Singapore.

Jorgenson, D.W. and B.M. Fraumeni, 1989, The accumulation of human and nonhuman capital, 1948-84. In: R. Lipsey and H. Stone Tice (eds.), The measurement of saving, investment and wealth, National Bureau of Economic Research (52), pp. 227-285.

Kendrick, J.W., 1977, The formation and stocks of total capital, National Bureau of Economic Research, vol. 100, New York.

Kiker, B.F., 1966, The historical roots of the concept of human capital, Journal of Political Economy, pp. 481-500.

Kuhry, B. and A. van der Torre, 2002, De vierde sector, SCP, The Hague.

OECD, 2010, Education at a Glance.

Romer, P., 1986, Increasing returns and long run growth, Journal of Political economy. Vol. 94, No. 5. (Oct., 1986), pp. 1002-1037.

Samuelson, P.A., 1961, The evaluation of 'social income', capital formation and wealth. In:

Lutz, F.A. and D.C. Hague (eds.), The theory of capital (London).

Schultz, T.W., 1960, Capital formation by education. Journal of Political Economy, December, pp. 571-584.

Schultz, T.W., 1961, Investment in human capital: reply, American Economic Review, pp. 1035-1039.

Seers, D. and R. Jolly, 1966, The treatment of education in national accounting, Review of Income and Wealth, pp. 195-209.

UN, 1947, Measurement of national income and the construction of social accounts. Studies and reports on statistical methods no. 7 (UN, Geneva).

UN, 1968, A System of National Accounts. Studies in methods, series F, no. 2, Rev. 3 (UN, New York).

UN and other international organizations, 2008, Revised System of National Accounts: Chapters and Annexes (SNA 2008)..